



Province of the
EASTERN CAPE
EDUCATION

BCM

AIM TO PASS

GRADE 12 LIFE SCIENCES REVISION DOCUMENT PAPER 2 Teacher's Book 2024



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1. DNA Code of Life

TERMINOLOGY

	DESCRIPTION	TERM
1	A tangled network of DNA and protein located within the nucleus	Chromatin network ✓
2	The bonds that hold the two strands of a DNA molecule together.	Hydrogen bonds ✓
3	The sugar found in DNA	Deoxyribose sugar ✓
4	The analysis of DNA samples to identify individuals that may be related	DNA Profiling ✓
5	The process whereby DNA makes an exact copy of itself	DNA replication ✓
6	The monomers of nucleic acids	Nucleotides ✓
7	The natural shape of a DNA molecule	Double helix ✓
8	Sections of DNA that carry hereditary information	Gene ✓
9	The sugar that forms part of a nucleotide in RNA	Ribose ✓
10	The process whereby mRNA is formed from DNA	Transcription ✓
11	Base triplets found on mRNA	Codons ✓
12	The cell organelle to which mRNA attaches during protein synthesis	Ribosome ✓
13	The process of arranging amino acids according to the sequence of bases on mRNA	Translation ✓
14	The organelle in a cell where translation occurs	Ribosome ✓
15	The triplet of bases found on a tRNA molecule	Anticodon ✓
16	The type of RNA containing anticodons	tRNA ✓
17	Bonds that join amino acids together	Peptide bond ✓
	(17 X 1)	(17)

Question 1.1

- | | | |
|-------|--|------------|
| 1.1.1 | (a) Y✓ | (1) |
| | (b) X✓ | (1) |
| 1.1.2 | 4✓ | (1) |
| 1.1.3 | A C T G (Must be in the correct order) ✓ | (1) |
| 1.1.4 | (DNA) replication✓ | (2) |
| | Transcription (Protein synthesis) ✓ | |
| | | (6) |

Question 1.2

- | | | |
|-------|--------------------------------------|------------|
| 1.2.1 | (a) W- Nucleotide ✓ | (2) |
| | U – DNA ✓ | |
| | (b) X - Phosphate ✓ / phosphate ions | (2) |
| | Y – Deoxyribose ✓ | |
| | (c) Hydrogen bond | (1) |
| | (d) V – Adenine | (1) |
| 1.2.2 | Nucleus✓ | (1) |
| 1.2.3 | Interphase✓ | (1) |
| | | (8) |

Question 1.3

- | | | |
|-------|---|------------|
| 1.3.1 | Heila ✓ and Leo ✓ | (2) |
| | (Mark first TWO only) | |
| 1.3.2 | - All the (DNA) bands from Heila and Leo ✓ | |
| | - match with the DNA of the mother and father ✓ | |
| | OR | |
| | - none of the (DNA) bands from Priya ✓ | (2) |
| | - match with the (DNA) bands of the mother and the father ✓ | |
| 1.3.3 | - Tracing missing persons✓ | |
| | - Identification of genetic disorder's ✓ | |
| | - Identification of suspects in a crime ✓ | |
| | - matching tissues for organ transplants ✓ | |
| | - Identifying dead persons ✓ | (3) |
| | (Mark first THREE only) | (7) |

Question 1.4

- 1.4.1 DNA Profiling✓ (1)
- 1.4.2 Jennie✓ (1)
- 1.4.3 -Jennie's DNA profile✓ /bands
matches DNA profile/ bands of the sample✓ from the crime scene (2)
- 1.4.4 -Proof of paternity✓
- Tracing missing person✓
- Identification of genetic disorders✓
- Establishing family relationships✓
- Matching tissues for organ transplants✓ (1)
- identifying dead persons✓/ animals.
- 1.4.5 - Samples containing DNA can be planted✓/person was framed
- Human error✓ during DNA profiling process
- Costly procedure✓
- Invasion of privacy✓ (2)
- (Mark first TWO only)** any 2 **(7)**

Question 1.5

- 1.5.1 Nucleus ✓ (Nucleoplasm) (1)
- 1.5.2 (a) Deoxyribose✓ (1)
(b) Uracil ✓ /U (1)

1.5.3

Transcription	DNA replication
Only one strand acts as a template ✓	Both strands acts as a template ✓
(Free) RNA nucleotides are complementary ✓	(Free) DNA nucleotides are complementary ✓
Adenine complements with uracil / (A complements with U) ✓	Adenine complements with thymine / (a complements with T) ✓
Only a short section of DNA is used ✓	The whole DNA molecule is used
DNA unwinds and unzips partially ✓	DNA unwinds and unzips completely ✓

(Mark first TWO only)

1 mark for table + (Any 2 x2)

(5)
(8)

Question 1.6

- 1.6.1 (a) Amino acids ✓ (1)
 (b) mRNA ✓ (1)
- 1.6.2 (a) TAC ✓✓ (2)
 (b) GUA ✓ (1)
- 1.6.3 Translation ✓*
 - Each RNA carries a specific amino acid ✓
 - when the anticodon on tRNA ✓ / GUA
 - matches the codon on mRNA ✓ / CAU
 - then tRNA brings the required amino acid to the ribosome ✓
 - amino acids become attached to each other by the peptide bonds ✓
 - to form the required protein ✓ **1* compulsory + 6**
- (7)
(12)

Question 1.7

- 1.7.1 Transcription ✓ (1)
- 1.7.2 mRNA ✓ (1)
- 1.7.3 -makes up the genes which carry hereditary information
 -contains coded information for protein synthesis (2)
- 1.7.4 ✓
- | A (DNA) | B (RNA) |
|----------------------------------|----------------------------------|
| Double strand ✓ / Paired bases ✓ | Single strand ✓ Unpaired bases ✓ |
| Double helix / helical ✓ | Non- helical ✓ |
| Thymine ✓ | Uracil ✓ |
- 1 mark for table + 2 X 2**
- (5)
- 1.7.5 - The double helix DNA unwinds ✓ and
 - unzips ✓ / weak hydrogen bonds break
 - to form two separate strands ✓
 - one strand acts as a template ✓
 - to form mRNA ✓
 - using free nucleotides from the nucleoplasm ✓
 - the mRNA is complementary to the DNA ✓ (6)
 - the copied message for protein synthesis is thus copied
 Onto mRNA ✓ **(Any 6)**

- 1.7.6 - This will result in different tRNA molecules ✓
 - bringing different amino acids ✓
 - leading to the formation of a different protein. ✓ (3)
(18)

Question 1.8

- 1.8.1 Gene ✓ mutation
 1.8.2 - There is change in sequence (of nitrogenous bases) from CCG (1)
 To CUG ✓
 1.8.3 (a) 5 ✓/Five (1)
 (b) UAU ✓ (1)
 (c) -The codon CCG changed to CUG ✓ / 4th codon has changed
 - The anticodon/ tRNA sequence changed ✓
 - The amino acids proline ✓
 - Was replaced by Leucine ✓ (4)
 - This resulted in a different protein✓/no protein being formed (8)

Question 1.9

- 1.9.1 (a) Transcription✓ (1)
 (b) Translation✓ (1)
 1.9.2 (a) Nucleus✓ (1)
 (b) mRNA✓ (1)
 1.9.3 Chloroplasts✓ (2)
 Mitochondria✓
 1.9.4 (a) - The double helix DNA unwinds✓ and
 - (the double-stranded DNA) unzips✓/weak hydrogen bonds break
 - to form two separate strands✓
 - One strand is used as a template✓
 - to form mRNA✓
 - using free (RNA) nucleotides✓ from the nucleoplasm
 - The mRNA is complementary to the DNA✓/ (A-U, G-C)
 - mRNA now has the coded message for protein synthesis✓ (7)
 (b) - Each tRNA carries an amino acid✓
 - When the anticodon on the tRNA✓
 - matches the codon on the mRNA✓
 - the tRNA brings the (required) amino acid to the ribosome✓
 - Amino acids become attached by peptide bonds✓
 - to form the (required) protein✓ (6)

- 1.9.5 (a) TCG✓ (1)
- (b) Tyrosine✓ (2)
- Valine✓
- 1.9.6 Gene mutation✓ (1)
- 1.9.7 - The anticodon will be GGA✓/not GAA (3)
- The last amino acid would be proline instead of leucine✓
- resulting in a different protein✓/ no protein at all
- (26)**

Question 1.10

- 1.10.1 Cytosine✓ (1)
- 1.10.2 20✓✓% (2)
- 1.10.3 G A A✓ U G U✓ (2)
- 1.10.4 Glutamic acid✓ - Cysteine✓ (in that order) (2)
- 1.10.5 U A C✓ (1)
- (8)**

2. MEIOSIS

BIOLOGICAL TERMS:

	DESCRIPTION	TERM
1	The point of crossing over between two adjacent chromosomes	Chiasma
2	The splitting of the cytoplasm during cell division	Cytokinesis
3	The failure of chromosome pairs to separate during meiosis	Non-disjunction
4	The structures in the cell that forms the spindle fibres.	Centrioles
5	The phase of meiosis when homologous chromosomes are aligned at the equator of the cell.	Metaphase I
6	The division of the nucleus	Karyokinesis
7	Exchange of genetic material between chromatids of homologous chromosomes	Crossing over
8	The point at which the two chromatids of a chromosome are joined together	Centromere
9	Site of meiosis in females	Ovaries
10	A genetic disorder caused by having an extra copy of chromosome number 21	Down syndrome
11	The Structure formed by the centrioles during cell division	Spindle fibres
12	The non-sex chromosomes in humans	Autosomes
13	The condition in a cell where there is only one set of Chromosomes	Haploid
14	The structure that is responsible for the formation of spindle fibres during cell division in animal cells and is made up of two centrioles	Centrosomes
15	The phase in the cell cycle during which the cell growth occurs	Interphase
16	Chromosomes that carry the same set of genes	Homologous
17	The structure that joins two chromatids of a chromosome	Centromere
18	The division of the cytoplasm of a cell during cell division	Cytokinesis
19	The process during meiosis where there is an exchange of genetic material between chromatids.	Crossing over
20	The structures in animal cells that give rise to spindle fibres during cell division.	centrosome
21	The phase in the cell cycle during which DNA replication takes place	interphase
22	The point where adjacent chromatids overlap during meiosis May June	Chiasma /chiasmata
23	The representation showing the arrangement of a diploid set of chromosomes	karyotype
(23 x 1)		(23)

Question 2.1

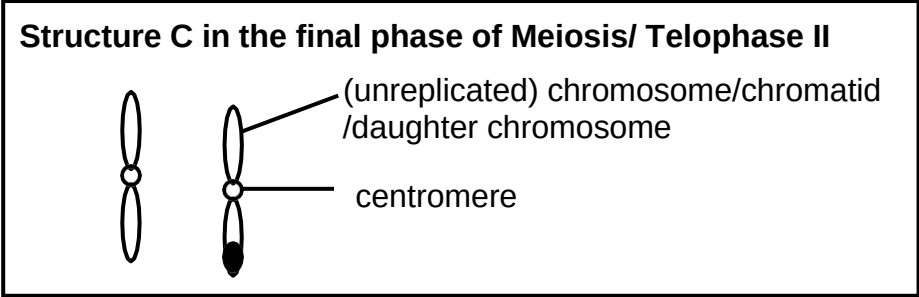
- 2.1.1. (a) Centromere✓ (1)
(b) Homologous chromosomes✓ (1)
(c) Spindle fibres✓ / spindle threads (1)
- 2.1.2. Anaphase II✓ (1)
- 2.1.3. 2, 1, 3✓✓ (2)
- 2.1.4. In metaphase I, the chromosomes arrange at the equator in homologous pairs✓
whereas in metaphase II, the chromosomes arrange at the equator singly✓
(Mark first ONE only) (2)
(8)

Question 2.2

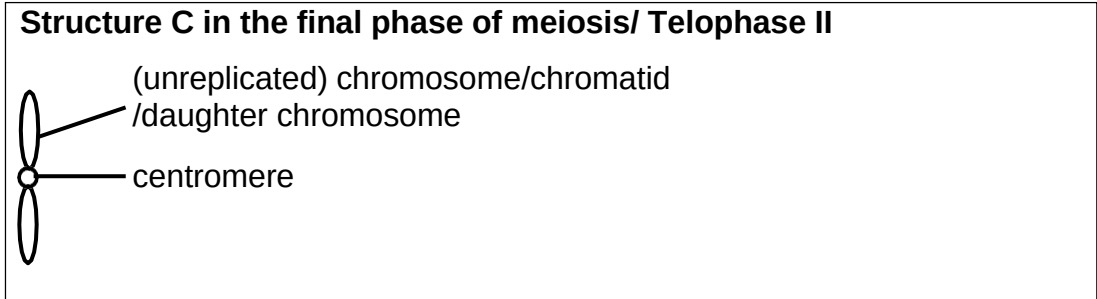
- 2.2.1. Anaphase II✓ (1)
- 2.2.2 (a) Centrosome✓ (1)
(b) Centromere✓ (1)
(c) Spindle fibre✓ / Spindle threads (1)
- 2.2.3 The chromatids separate✓ / centromere splits (1)
- 2.2.4 Crossing over✓ (1)
- 2.2.5 Reduces genetic variation✓ (1)
- 2.2.6 (a) Four✓ / 4 (1)
(b) 23✓ (1)
(09)

Question 2.3

- 2.3.1. Metaphase II✓ (1)
- 2.3.2. Individual chromosomes line up at the equator✓✓ of the cell
(Mark first one only) (2)
- 2.3.3. a) Cell membrane✓ (1)
b) Spindle fibres✓ (1)
- 2.3.4. - It contracts✓ / shortens
- to pull the chromosomes✓ / daughter chromosomes / chromatids to opposite poles of the cell (2)



OR



Guideline for assessing the drawing

CRITERIA	ELABORATION	MARK
Heading (H)	-Structure C in the final phase of meiosis/Telophase II	1
Correct drawing (D)	-Daughter chromosome/unreplicated chromosome/chromatid/s drawn from structure C only	1
Correct shading (S)	-One unshaded OR one with shaded tip unshaded	1
Labels (L)	-Any correct label	1

(4)

(11)

}-

Question 2.4

- 2.4.1. (a) Metaphase I✓ (1)
(b) Telophase I✓ (1)
- 2.4.2. (a) B✓ (1)
(b) C✓ (1)
(c) D✓ (1)
- 2.4.3. Testis✓ (1)
- (6)**

Question 2.5

- 2.5.1 Autosomes✓ (1)
- 2.5.2 a) – One chromosome comes from the sperm✓/father
- and other comes from the ovum✓/mother (2)
- b) – Shape✓
- Size✓/length
- Position of genes✓/alleles
- Genes coding for same characteristic✓
- Location of centromere✓
- (Mark the first THREE only)** (3)
- 2.5.3 - Gonosomes are not identical✓/chromosomes at position 23 are not identical
- Individual 1 has XY gonosomes✓/is a male
- Individual 2 has XX gonosomes✓/ is a female (3)
- (9)**

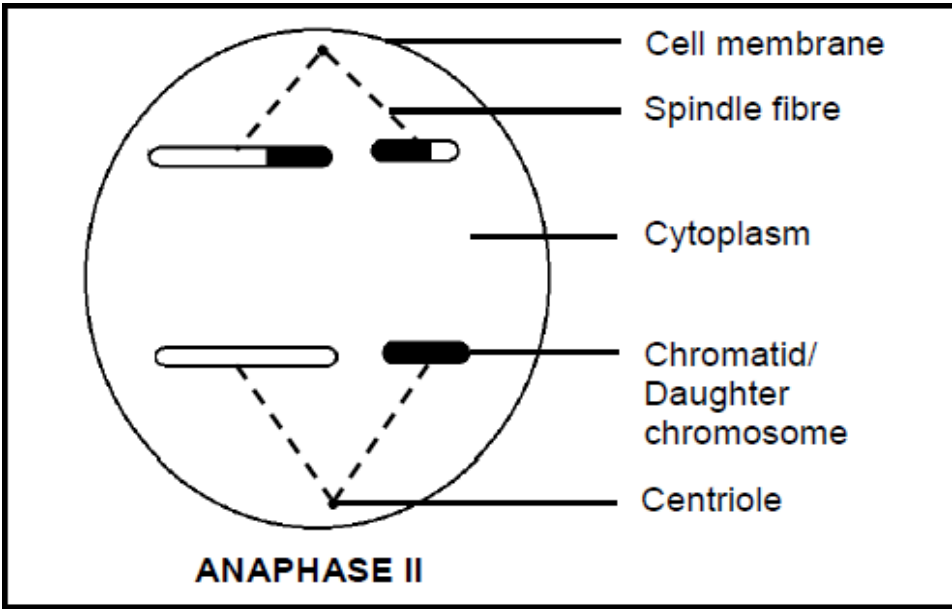
Question 2.6

- 2.6.1. (a) Down syndrome✓ (1)
(b) Anaphase I/II✓ (1)
(c) Chromosomal aberration✓ (1)
- (3)**

Question 2.7

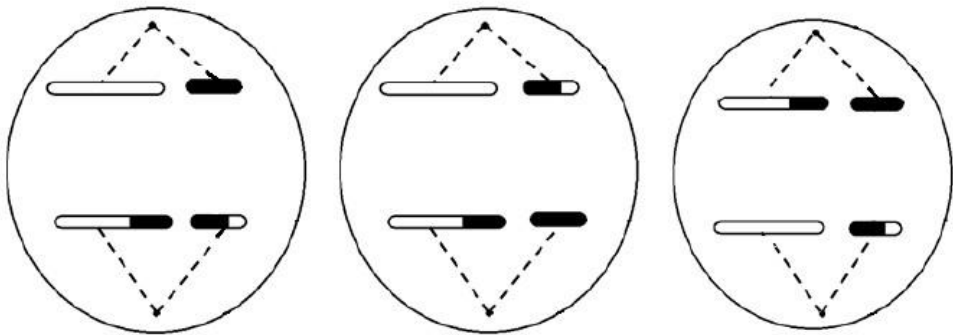
- 2.7.1. - Due to non-disjunction✓/ non-separation of a chromosome pair
 - during Anaphase I✓
 - Two chromosomes moved to the one pole✓ and
 - none moved to the other pole✓
(3)
- 2.7.2. - Gamete **A** will have 24 chromosomes✓/ extra chromosome
 - and when it fertilises a normal ovum✓/ gamete with 23 chromosomes
 - the zygote will have 3 chromosomes at position 21✓/ 47 chromosomes
(3)
- 2.7.3. (a) Prophase I (1)
 (b) - Adjacent chromatids of homologous chromosomes cross✓
 - At a point called the chiasma✓
 - There is an exchange of DNA segments✓/genetic material
(3)
(10)

Question 2.8



OR

ANY ONE OF THE FOLLOWING ARRANGEMENTS INCLUDING CORRECT LABELS



MARK ALLOCATION FOR DIAGRAM

Correct phase drawn/chromatids separating (P)	1
Correct shading of chromatids (S)	1
Correct number and size of individual chromatids/daughter chromosomes (2 short and 2 long) (N)	1
Any TWO correct labels	2
TOTAL	5

(5)

(5)

(5)

Question 2.9

- | | | |
|--------|---|-------------|
| 2.9.1. | Centromere✓ | (1) |
| 2.9.2. | Metaphase I✓ | (1) |
| 2.9.3. | - A pair of chromosomes with the same structure✓/location of centromere/ length and
- the same sequence of genes✓
- One is of maternal origin and the other of paternal origin✓ | (3) |
| 2.9.4. | - Some chromatids have a mixture of genetic material✓ from its homologue
- as crossing over✓ took place
- during Prophase I✓ | (3) |
| 2.9.5 | The spindle fibres contract to pull the chromatids apart✓/to opposite poles | (1) |
| 2.9.6 | 48✓✓ arbitrary units. | (2) |
| | | (10) |

Question 2.10

- | | | |
|---------|---|-------------|
| 2.10.1. | Centrosome✓ | (1) |
| 2.10.2. | Anaphase I✓ | (1) |
| 2.10.3. | - The spindle fibres contract✓
- The centromeres split✓
- Each chromatid is pulled to the opposite poles✓ | (2) |
| | Any 2 | |
| 2.10.4. | Crossing over✓ | (1) |
| 2.10.5. | It leads to (genetic) variation✓
(Mark first ONE only) | (1) |
| 2.10.6. | 46✓/23 pairs | (1)\ |
| 2.10.7. | Structure B consists of two DNA molecules✓/ contains a double thread/ is made up of two chromatids
-because of DNA replication✓
- Structure C consists of one DNA molecule✓/ contains a single thread/ chromatid
- because it is unreplicated✓/ as a result of splitting of the chromosome during anaphase 2 | (3) |
| | Any | |
| | | (10) |

Question 2.11

- 2.11.1. a) Centrosome✓ (1)
b) Chromosome✓ (1)
c) Cell membrane✓ (1)
- 2.11.2. a) 2✓ - Metaphase II✓ (2)
b) 4✓ - Prophase I✓ (2)
c) 1✓ - Anaphase I✓ (2)
- 2.11.3. a) 2✓ (1)
b) 23✓ (1)
c) 46✓ (1)
- (12)**

Question 2.12

- 2.12.1. a) Meiosis✓ / Meiosis I (1)
b) Prophase I✓ (1)
- 2.12.2. Ovary✓ (1)
- 2.12.3. C✓ - centromere✓ (2)
- 2.2.4. 3✓ / Three (1)
- (6)**

Question 2.13

- 2.13.1 (a) centromere✓ (1)
· (b) Chiasma✓ / chiasmata (1)
(c) Homologous chromosomes✓ / -chromosome pair/bivalent (1)
(d) Chromatid✓ / sister chromatid (1)
- 2.13.2 - Similar shape✓ / similar centromeres
· - size✓ and
- genetic composition✓ (2)
- (Mark first TWO only)**
- 2.13.3 - In prophase 1✓
· - Non-sister chromatids/ one chromatid of each homologous chromosome pair✓
- Touch✓ / overlap
- At a point called chiasma✓
- DNA/ genetic material is crossed over✓ / swopped at the chiasma. (5)

- 2.13.4 (a) 21✓ (1)
- (b) 42✓ (1)
- (c) 21✓ (1)
- (14)**

Question 2.14

- When chromosome pair 21/chromosome 21 fail to separate✓
 - during Anaphase✓
 - the daughter cells (gametes) will have 24 chromosomes✓/an extra chromosome
 - when this gamete is fertilised by a normal gametes✓ with 23 chromosomes.
 - the zygote will have 47 chromosomes✓/3 chromosomes at position 21/Trisomy 21
- (5)**

QUESTION 2.15

- 2.15.1. (a) Prophase 1✓ (1)
- (b) Twelve✓ (1)
- (c) Three / 3✓ (1)
- 2.15.2 (a) Nuclear membrane✓ (1)
- (b) Cell membrane✓ / plasmalemma / plasma membrane (1)
- (c) Nuclear membrane✓ (1)
- 2.15.3 -Testes✓ (1)
- Ovaries✓ (1)
- (8)**

Question 2.16

- 2.16.1 5/ Five✓ (1)
- 2.16.2 Gonosomes✓ / sex chromosomes (1)
- 2.16.3 (a) Down Syndrome✓ / Trisomy 21 (1)
- (b) Non- disjunction✓ (1)
- 2.16.4 Male✓ (1)
- (5)**

3. GENETIC SOLUTIONS

TERMINOLOGY:

	DESCRIPTION	TERM
1	The study of heredity and variation in organisms	Genetics
2	All the genes that make up an organism	Genome
3	Two or more alternative forms of a gene at the same locus	Alleles
4	The position of a gene on a chromosome	Locus
5	The non-sex chromosomes in humans	Autosomes
6	An inherited disorder where blood fails to clot properly	Haemophilia
7	The number, shape and arrangement of all chromosomes in the nucleus of a somatic cell	Karyotype
8	A genetic cross involving one gene and its alleles	Monohybrid
9	A genetic disorder where blood does not clot	Haemophilia
10	The use of living organisms and their biological processes to improve the quality of human life	Biotechnology
11	The type of inheritance involving two alleles that are not dominant over one another	Incomplete dominance
12	Characteristics controlled by genes which are located on the sex chromosomes	Sex-linked
13	The type of inheritance involving alleles that equally determine the phenotype of heterozygous offspring	Codominance
14	An allele that is expressed phenotypically only in the homozygous condition	Recessive
15	The physical and functional expression of a gene	Phenotype
16	The production of a genetically identical copy of an organism using biotechnology	Cloning
17	The manipulation of the genetic material of an organism to get desired changes	Genetic engineering
18	A diagram showing the inheritance of genetic disorders over many generations	Pedigree diagram
19	An allele that does not influence the phenotype when found in the heterozygous condition	Recessive
20	Organisms having two identical alleles at a given locus	Homozygous
21	An allele that is always expressed in the phenotype	Dominant
22	An individual having two non-identical alleles for a characteristic	Heterozygous
23	A segment of a chromosome that codes for a particular characteristic	Gene
24	The type of inheritance which produces an intermediate phenotype	Incomplete dominance
		24 x1 = (24)

Question 3.1

3.1.1 Incomplete dominance✓ (1)

3.1.2 - The pink flower colour is an intermediate phenotype✓/ a blend of red and white indicating that neither of the alleles is dominant✓ (2)

P₁

Phenotype

Genotype

Meiosis

F₁

Genotype

Phenotype

P₁ and F₁✓

Meiosis and fertilisation✓

Pink

x

Pink✓

RW

x

RW✓

R, W

x

R, W✓

RR;

RW;

RW;

WW✓

1 Red: 2 Pink: 1 White✓*

OR

P₁

Phenotype

Genotype

Meiosis

F₁

Phenotype

P₁ and F₁✓

Meiosis and fertilisation✓

Pink

x

Pink✓

RW

x

RW✓

Gametes	R	W
R	RR	RW
W	RW	WW

1 mark for correct gametes
1 mark for correct genotypes

1* compulsory + Any 5

(6)

(9)

Question 3.2

3.2.1

P₁	Phenotype	Male	x	Female✓
	Genotype	XY	x	XX✓
<i>Meiosis</i>				
	G/gametes	X, Y	x	X, X✓
<i>Fertilisation</i>				
F₁	Genotype	XX;	XX;	XY; XY✓
	Phenotype	female : male✓		

P₁ and F₁✓
Meiosis and fertilisation✓

OR

P₁	Phenotype	Male	x	Female✓
	Genotype	XY	x	XX✓
<i>Meiosis</i>				
<i>Fertilisation</i>				

Gametes	X	Y
X	XX	XY
X	XX	XY

1 mark for correct gametes
1 mark for correct genotypes

F₁ Phenotype female: male✓
P₁ and F₁✓
Meiosis and fertilisation✓

Any (6)

- 3.2.2
- Normal females have two X ✓ chromosomes
 - Normal males have one X and one Y✓
 - The female always provides X in the egg✓
 - If an egg cell is fertilized by an X bearing sperm ✓ a female/girl✓ is formed
 - If an egg is fertilized by a Y bearing sperm
 - a male/boy✓ is formed

Any (5)

OR

Gametes		male gamete✓	
		X	Y
female gamete✓	X	XX✓	XY✓

2 XX : 2 XY

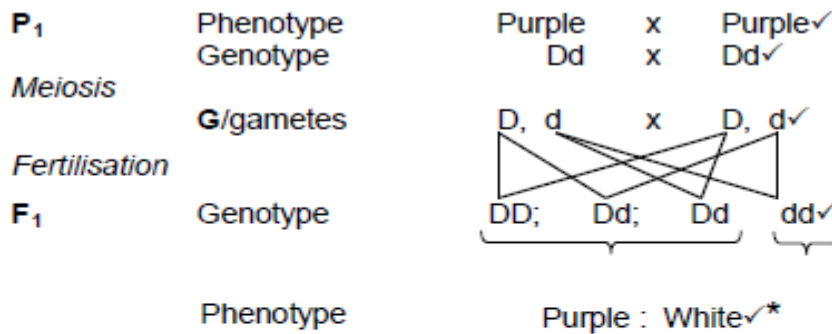
Female ✓ Male✓

(Any

(11)

Question 3.3

- 3.3.1 Purple ✓ (1)
- 3.3.2 -When purple-flowering plants and white-flowering plants are crossed ✓
 – all the offspring have purple flowers ✓/have no white flowers (2)
- 3.3.3 The two alleles for a characteristic ✓
 – separate during meiosis ✓ so that
 – each gamete contains only one allele ✓ for that characteristic (3)
- 3.3.4



P₁ and
F₁ ✓
Meiosis and fertilisation ✓

*Compulsory 1 + Any 5

OR

P₁ Phenotype Genotype Purple Dd x Purple Dd ✓

Meiosis

Fertilisation

Gametes	D	d
D	DD	Dd
d	Dd	dd

1 mark for correct gametes
1 mark for correct genotypes

F₁ Phenotype Purple: White ✓*

P₁ and
F₁ ✓
Meiosis and fertilisation ✓

(6)
(12)

Question 3.4

- 3.4.1 ffHh ✓ (1)
- 3.4.2 (a) (a) FfHh ✓✓ (2)
 (b) (b) 3 ✓ (1)
 (c) (c) h ✓ (1)
 (d) (d) Long fingers and continuous hairline ✓✓ (2)

(7)

Question 3.5

- 3.5.1 Dihybrid✓ cross (1)
3.5.2 TTrr✓✓ (2)
3.5.3 TR✓, Tr✓, tR✓, tr✓ (4)
(7)

Question 3.6

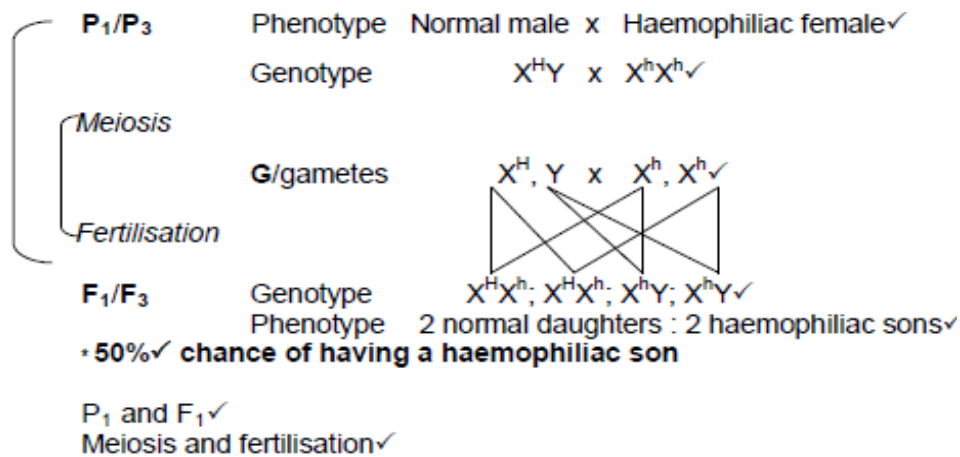
- 3.6.1 Pedigree✓ diagram (1)
3.6.2 (a) 6✓ (1)
(b) 1✓ (1)
3.6.3 $X^G X^g$ ✓✓ (2)
3.6.4 Unaffected✓✓ / without Goltz syndrome (2)
3.6.5 - Pilusa is affected ✓ $X^G Y$
- Anju is unaffected✓ $X^g X^g$
- Males inherit the Y chromosome from Pilusa✓
- and inherit X^g from Anju✓ (4)
(11)

Question 3.7

- 3.7.1 (a) Normal female✓ (1)
(b) $X^H X^h$ ✓✓ (2)
3.7.2 - Haemophilia is caused by a recessive allele✓
- Carried on the X chromosome✓
- Females have two X chromosomes✓ / Males only have one X chromosome
- Females must inherit two copies of the recessive allele✓ / females who inherit only one of the recessive allele are still normal

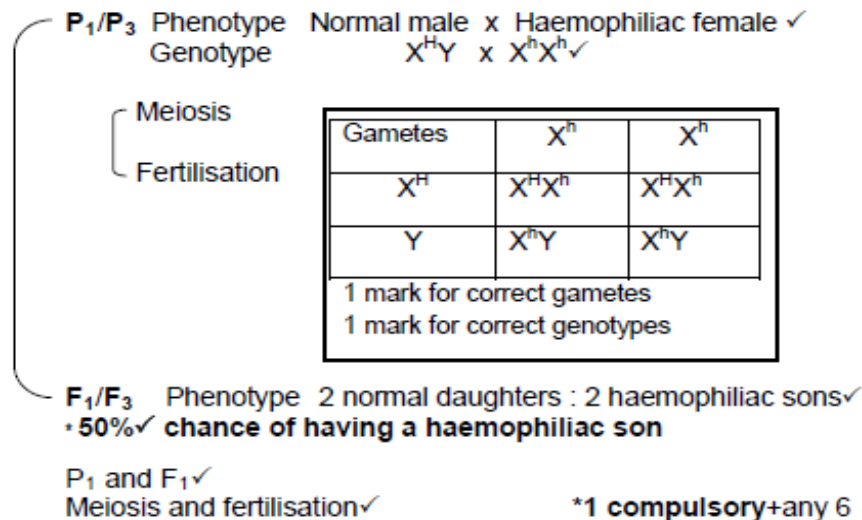
Any (3)

3.7.3



*1 compulsory +any 6

OR



*1 compulsory+any 6

(7)

(13)

Question 3.8

3.8.1 A change in the sequence✓ of nitrogenous bases✓/ nucleotides in a gene (2)

3.8.2 Nigeria ✓% (1)

3.8.3 $\frac{39\,746}{305\,733} \times 100 = 13\%$ (3)

3.8.4 (a) dd✓ (1)

(b) Dd✓ (1)

(8)

Question 3.9

- 3.9.1 (a) 3✓ /Three (1)
(b) 2✓ /Two (1)
- 3.9.2 Hearing✓ (1)
- 3.9.3 - Bob and Ann can both hear✓
- They have a child who is deaf✓ /who has the genotype aa
- This means that each parent carries an allele for deafness✓ /are heterozygous/Aa
- but it is masked✓ by the dominant allele /which is for hearing (4)
- 3.9.4 AA✓ and Aa✓ (2)
(9)

Question 3.10

- 3.10.1 - Spine✓
- Hips✓
(Mark first TWO only) (2)
- 3.10.2 - A change in the sequence✓
- of nitrogenous bases✓ /nucleotides in DNA (2)
- 3.10.3 - To check for the gene mutation✓
- and if it results in the high bone density✓ (2)
- 3.10.4 Produces high bone density✓ /reduces the risk of bone fractures (1)
- 3.10.5 $\frac{13}{20} \times 100 = 65\%$ OR $\frac{7}{20} \times 100 = 35\%$
 $(100 - 35) = 65\%$ (3)
(10)

Question 3.11

- 3.11.1 (a) 4✓ /Four (1)
(b) 1✓ /One (1)
- 3.11.2 |A_j✓✓ (2)
- 3.11.3 (a) Son 1✓ (1)
(b) Mother✓ (1)
(c) Son 1✓ (1)
(7)

Question 3.12

- 3.12.1 $I^A \checkmark \quad I^B \checkmark \quad i \checkmark$ (3)
- 3.12.2 2✓ (1)
- 3.12.3 - Any individual inherits one allele✓ (2)
- from each parent✓
- 3.12.4 - Each child✓ (3)
- has an equal✓/25% chance of having
- any blood group✓/ A, B, AB, or O. (9)

Question 3.13

- 3.13.1 3✓/ Three (1)
- 3.13.2 - Complete dominance✓
- The allele for blood group B/ I^B is dominant✓✓ and
- the allele for blood group O/ i is recessive✓✓ (3)

3.13.3

P₁	Phenotype:	Blood group AB	x	Blood group B✓
	Genotype:	$I^A I^B$	x	$I^B i \checkmark$

Meiosis

G/gametes	I^A	I^B	x	I^B	$i \checkmark$
------------------	-------	-------	---	-------	----------------

Fertilisation

F₁	Genotype:	$I^A I^B$	$I^A i$	$I^B I^B$	$I^B i \checkmark^*$
	Phenotype:	Blood group: AB;	A;	B✓*	

P₁ and F₁✓
Meiosis and fertilisation✓

Compulsory 2*+ Any 4

OR

P₁ Phenotype: Blood group AB x Blood group B✓
 Genotype: $I^A I^B$ x $I^B i$ ✓

(6)

Meiosis

Fertilisation

Gametes	I^A	I^B
I^B	$I^A I^B$	$I^B I^B$
i	$I^A i$	$I^B i$

1 mark for correct gametes
 1 mark for correct genotypes*

(10)

F₁ Phenotype: Blood group:
 AB; A; B✓*

P₁ and F₁✓

Meiosis and fertilisation✓

Compulsory 2*+ Any 4

Question 3.14

P₁	Phenotype	Woman without haemophilia	x	Man with haemophilia✓
	Genotype	$X^H X^h$	x	$X^h Y$ ✓
<i>Meiosis</i>				
	G/gametes	X^H , X^h	x	X^h , Y✓
<i>Fertilisation</i>				
F₁	Genotype	$X^H X^h$, $X^H Y$, $X^h X^h$, $X^h Y$ ✓		
	Phenotype	1 daughter without haemophilia, 1 daughter with haemophilia, 1 son without haemophilia, 1 son with haemophilia✓		
		0%✓*chance of a daughter homozygous for normal blood clotting		
P ₁ and F ₁ ✓				
Meiosis and fertilisation✓				
*1 compulsory mark + any 6				

3.15.2	P₁	Phenotype	Male with brown teeth	x	Female with white teeth✓
		Genotype	X ^B Y	x	X ^b X ^b ✓
		<i>Meiosis</i>			
		G/gametes	X ^B , Y	x	X ^b , X ^b ✓
		<i>Fertilisation</i>			
	F₁	Genotype	X ^B X ^b , X ^B X ^b , X ^b Y, X ^b Y✓		
		Phenotype	1 female with brown teeth: 1 male with white teeth✓*		
	P ₁ and F ₁ ✓				
	Meiosis and fertilisation✓				
	*1 compulsory mark + Any 5				
	OR				
	P₁	Phenotype	Male with brown teeth	x	Female with white teeth✓
		Genotype	X ^B Y	x	X ^b X ^b ✓
		<i>Meiosis</i>			
		<i>Fertilisation</i>			
			1 mark for correct gametes 1 mark for correct genotypes		
	F₁	Phenotype	1 female with brown teeth: 1 male with white teeth✓*		
		P ₁ and F ₁ ✓			
	Meiosis and fertilisation✓				
	*1 compulsory mark + Any 5				
					(6)
					(10)

Question 3.16

3.16.1	Dihybrid✓ cross		(1)
3.16.2	(a)	Smooth✓ stem	(1)
	(b)	Elongated✓ fruit	(1)
3.16.3	(a)	nnrr✓✓/nnrr/ rrnn	(2)
	(b)	Smooth stem round fruit✓✓	(2)
			(7)

Question 3.17

3.17.1	Dihybrid✓cross	(1)
3.17.2	(a) Brown✓ fur and long ears✓	(2)
	(b) bbee✓✓	(2)
	(c) Be✓ be✓	(2)
		(7)

Question 3.18

3.18.1	- Embryos✓ - Umbilical cord✓ - Bone marrow✓ (Mark first THREE only)	(3)
3.18.2	- Stem cells are undifferentiated✓ - and have the potential to develop into any type of cell✓ - to replace affected/defective cells✓ causing a disorder Any	(2)
3.18.3	- Stem cells are undifferentiated✓ - and have the potential to develop into any type of cell✓ to replace affected/defective cells✓ causing a disorder Any	(1)
		(6)

Question 3.19

- 3.19.1 - The nucleus of the somatic cell is diploid✓/ has a full set of chromosomes/has all the genetic material whereas
- the nucleus of the sperm cell is haploid✓/contains half the set of chromosomes/ has half the genetic material
- The somatic cell carries the desired characteristic✓/straight hair (3)
- 3.19.3 (Horse) S ✓ (1)
- 3.19.4 - To produce organisms with desired traits✓e.g. health, appearance, nutritious, yield, shelf life etc.
- Conservation of threatened species✓
- To create tissue/organs for transplant✓ Any (2)
- (Mark first TWO only)** (8)

4. EVOLUTION

TERMINOLOGY

	DESCRIPTION	TERM
1	A type of variation where there is a range of phenotype for the same characteristics	Continuous variation
2	Present day distribution of living organisms	Biogeography
3	The selection of desirable characteristics by humans	Artificial selection/ selective breeding
4	The process whereby new species are formed	Speciation
5	The type of variation in a population with no intermediate phenotype	Discontinuous variation
6	An explanation describing evolution as consisting of long phases of little change alternating with short phases of rapid change	Punctuated Equilibrium
7	The permanent disappearance of species from earth	Extinction
8	An explanation for something that has been observed in nature and which can be supported by facts, laws, and tested hypothesis	Theory
9	Organisms with similar characteristics, able to interbreed randomly and produce fertile offspring	Species
10	Structured in different organism that have similar basic plan which suggest that they share common ancestor	Homologous structures
11	The process that enables organisms with desirable characteristics to survive and reproduce in a particular environment	Natural selection
12	Remains of life forms preserved in rocks, ice, and dried sap trees	Fossils
13	Change in the characteristics of species over time	Biological evolution
14	Large, pointed teeth in African apes that are used for tearing food	Canine
15	The part of the skull that houses the brain	Cranium
16	Having a protruding jaw	Prognathous
17	A diagrammatic representation showing possible evolutionary relationships between different species	Phylogenetic tree/ Cladogram
18	The opening in the base of the skull through which the spinal cord passes	Foramen magnum
19	Family to which humans belong	Hominidae
20	An upright posture and walking only on two legs	Bipedalism
21	The type of vision shared by apes and humans that allows for depth perception	Stereoscopic vision
22	The act of walking on all four limbs	Quadrupedal
23	Similar structures that are inherited from a common ancestor and are modified for different functions	Homologous structures
24	The formation of new species	Speciation
	(24 X 1)	(24)

Question 4.1

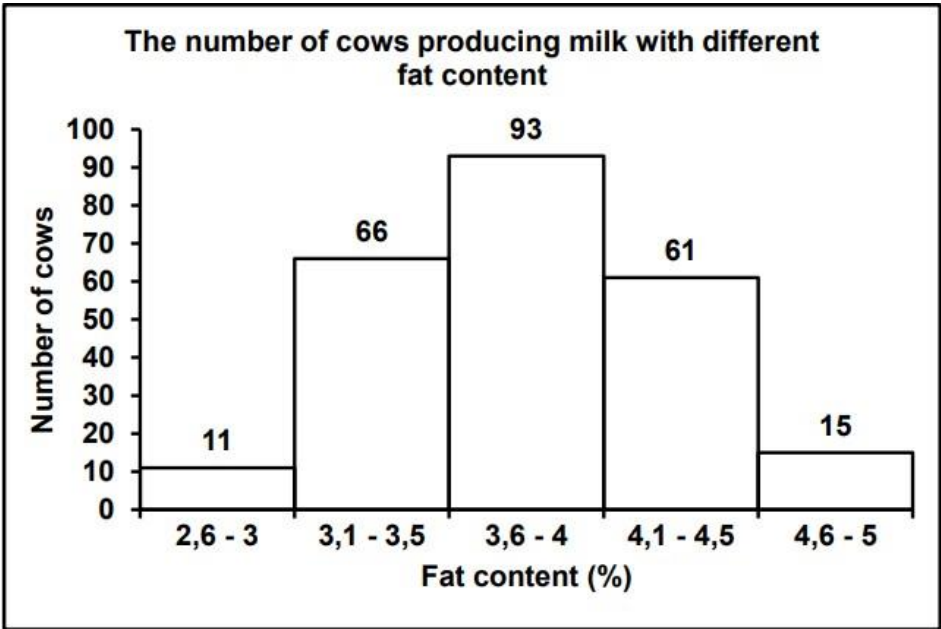
- 4.1.1 Genetic✓ evidence

(1)
- 4.1.2 1 – A✓ C
- 2 – C✓ OR A
- 3 – B✓ B

(3)
- (4)

Question 4.2

4.2.1



Guideline for assessing the graph

CRITERIA	ELABORATION	MARK
Correct type of graph (T)	Histogram drawn	1
Caption of graph (C)	Both variables included	1
Axes labels (L)	X- and Y-axis correctly labelled with units	1
Scale for X- and Y-axis (S)	- Same width of bars for X-axis and - Correct scale for Y-axis	1
Plotting of bars (P)	1 to 4 bars plotted correctly	1
	All 5 bars plotted correctly	2

- 11
- 4.2.2 246 ✓ x 100✓ = 4,47✓ % (Accept 4,5)

(3)
- 4.2.3 Continuous✓ variation

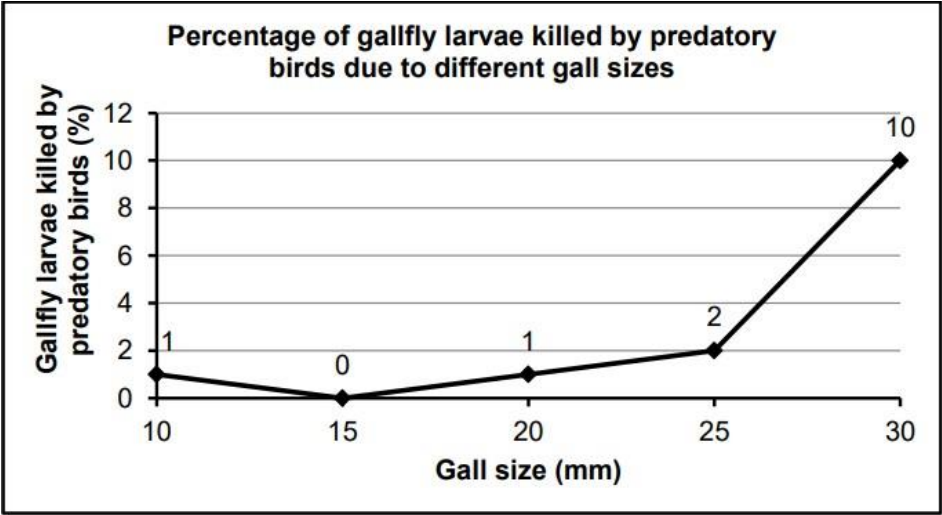
(1)
- 4.2.4 There is range of intermediate phenotypes✓ /the fat content % is a range

(1)

(11)

Question 4.3

- 4.3.1 (a) Gall size (1)
- 4.3.1 (b) Percentage of gallfly larvae killed (1)
- 4.3.2
 - nutrition / food (1)
 - protection
 - space (Any one)(Mark the first ONE only)
- 4.3.3
 - There is a range of (intermediate) values in gall size (1)
- 4.3.4



Guideline for the assessing of the graph

CRITERIA	ELABORATION	MARK
Correct type of graph (T)	Line graph drawn	1
Caption of graph (C)	Both variables included	1
Axes labels (L)	Correct labels and units on X- and Y-axes	1
Scale for X- and Y-axes (S)	Equal spacing between intervals for each axis	1
Plotting of points (P)	1 to 4 points plotted correctly All 5 points plotted correctly	1 2

(6)
(10)

Question 4.4

- Organisms produce a large number of offspring✓
 - There is variation✓ amongst the offspring
 - Some have favourable characteristics and some do not✓
 - When there is a change in the environmental conditions✓/ there is competition
 - organisms with favourable characteristics, survive✓
 - whilst organisms with unfavourable characteristics, die✓
 - The organisms that survive, reproduce✓
 - and pass on the allele for the favourable characteristic to their offspring✓
 - The next generation will therefore have a higher proportion of individuals with the favourable characteristic✓
- Any (7)

Question 4.5

- 4.5.1
- He would use his of use and disuse✓
 - and law of inheritance of acquired characteristics✓
 - The ancestor of spider monkeys had short tails✓
 - to be able to hold onto tree branches✓
 - As a result their tails became longer✓
 - and this characteristic was passed on to the next generation✓ Any (6)
- 4.5.2
- Evolution occurs by natural selection✓
 - There was variation in the ancestral population
 - Some spider monkeys had short tails✓
 - and some had long tails✓
 - The spider monkeys with long tails were able to hold onto tree branches✓ /did not
 - fall to the ground
 - and survived✓ /were not attacked by predators
 - Those with short tails could not hold onto tree branches✓ /fell on the ground
 - They died✓ /were attacked by predators (8)
 - The characteristic for long tails was passed to the offspring✓ Any (14)

Question 4.6

Lamarckism		Darwinism	
1	Variation of the offspring occurs when individuals in the population change. ✓	1	Variation in the offspring is inherited. ✓
2	Change occurs because of adaptation to the environment/ Law of use and disuse. ✓	2	Natural selection – individuals best suited to the environment survive. ✓
3	Individuals in the population change. ✓	3	The population as a whole changes. ✓
4	Acquired characteristics are inherited by offspring. ✓	4	Characteristic are passed on from generation to generation to enable individuals to survive in the environment. ✓

(Mark first THREE only)

(Any (3 x 2) + 1 for table)

(7)

Question 4.7

- 4.7.1 - As the wings were used less ✓
 - they became reduced in size ✓ / less developed
 - and could not be used for flying ✓
 - This acquired characteristic was passed on to the offspring ✓

(4
)

- 4.7.2 - Breeding at different times of the year ✓
 - Species-specific courtship behaviour ✓
 - Adaptations to different pollinators ✓
 - Infertile offspring ✓
 - Prevention of fertilisation ✓
 (Mark first THREE only) Any

(3)
(7)

Question 4.8

- 4.8.1 (a) (Species-specific) courtship behaviour ✓ (1)
 (b) Length of the (male long-tailed widowbird's) tails ✓ (1)

- 4.8.2 - A larger sample size ✓
 - Increases the reliability ✓ of the investigation

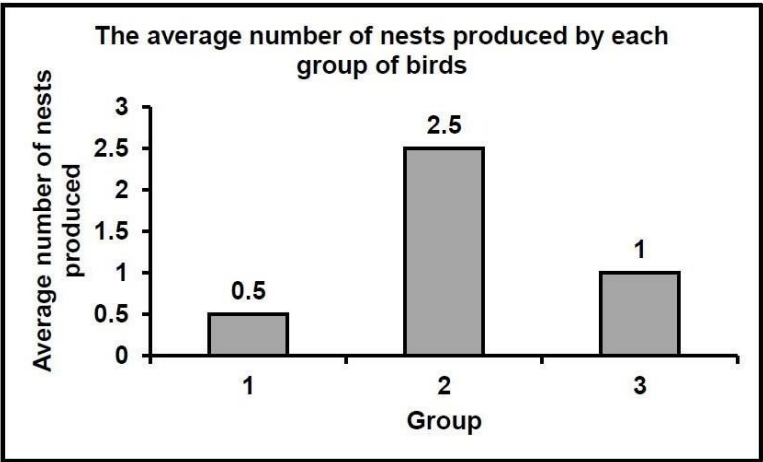
(2)

- 4.8.3 - To serve as a control ✓
 - so that it can be compared ✓ with the other groups
 - and show that the tails length is the only factor that affects the results ✓ / improves the validity of the investigation

Any

(2)

4.8.4



Guideline for assessing the graph

CRITERIA	ELABORATION	MARK
Correct type of graph (T)	Bar graph drawn	1
Caption of graph (C)	Both variables included	1
Axes labels (L)	X- and Y-axis correctly labelled	1
Scale for X- and Y-axis(S)	- Equal space between bars and width of bars for X-axis and - Correct scale for Y-axis	1
Plotting of bars (P)	1 to 2 bars plotted correctly All 3 bars plotted correctly	1 2

(6)

4.8.5 The longer the (male long-tailed widowbird's) tail, the higher the mating success✓✓

OR

The shorter the (male long-tailed widowbird's) tail, the lower the mating success✓✓

(2)
(14)

Question 4.9

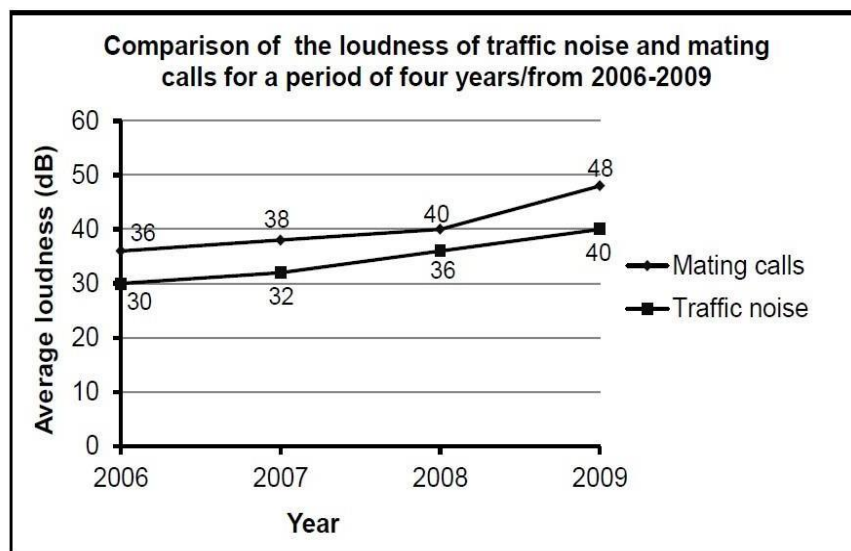
- 4.9.1 - The mating call can be easily heard✓/can be heard over a distance
- to ensure that a mate is attracted✓ (2)

- 4.9.2 - The investigation was done over a long period✓/6 years
- Many recordings were done in each year✓/ an average was calculated (1)
Any 1

- 4.9.3 As the traffic noise increased, the loudness of frogs' mating calls increased ✓✓ (2)

- 4.9.4 - Type of apparatus used✓
- Time of recordings✓
- Distance recordings are taken from✓
- Person taking measurements✓ (2)
Any 2
(Mark first TWO only)

4.9.5



CRITERION	ELABORATION	MARKS
TYPE	Two line graphs on the same set of axes (T)	1
KEY	A key or labels for each graph is present (K)	1
TITLE	Title of graph includes 3 variables	1
SCALE	Correct scale for X-axis and Y-axes (S)	1
LABELS	Correct label and unit for X-axis and Y-axis (L)	1
PLOTTING	Correct plotting of points	1: 1 to 7 points plotted correctly 2: Graph drawn for required years only, with all 8 points plotted correctly.

(7)

(14)

Question 4.10

4.10.1 1900✓ (1)

4.10.2 $\left\{\frac{80}{20}\right\} \times 100 = 400\%$

OR

$$\left\{\frac{(100-20)}{20}\right\} \times 100 = 400\%$$

(3)

4.10.3 | ✓

Natural selection	Artificial selection
The environment or nature is the selective force✓	Humans represent the selective force✓
Selection is in response to suitability to the environment✓	Selection is in response to satisfying human needs✓
Occurs within a species✓	May involve one or more species✓ (as in cross breeding)

(5)

(Mark first TWO only) 1 for Table + Any 2 x 2

(9)

Question 4.11

- 4.11.1 - It is characterised by long periods of little or no change✓
 - alternating with short periods of rapid change✓
 - during which new species may form✓

(3)

4.11.2 They contain toxins✓ which kill the snakes

OR

Too large✓ to be swallowed

Any

(1)

- 4.11.3 - Having a small jaw✓
 - means cane toads cannot be consumed✓
 - thereby protecting the snakes from ingesting the toxins✓

(3)

4.11.4 Since the snake's jaws were used less✓ /not used
 the snakes developed smaller jaws✓
 This characteristic (of a smaller jaw) was inherited by the offspring✓
 Over many generations the jaw of the snake became smaller✓

(4)

(11)

Question 4.12

- A population of a particular species becomes separated✓
- by a geographical barrier✓
- There is no gene flow between the separated populations✓
- Natural selection occurs independently in each population✓
- due to exposure to different environmental conditions✓/selection pressures
- The populations become very different✓from each other
- genotypically and phenotypically✓
- Even if the populations were to mix again✓
- they will not be able to interbreed✓
- The different populations are now new species✓

(6)

Any

Question 4.13

- 4.13.1 - There was once one large continent✓ and
- the common ancestor existed throughout this continent✓
 - When Madagascar separated✓
 - the common ancestor was found in both✓ regions

(4)

- 4.13.2 - The common ancestor became separated into two **groups** by the ocean✓*
- There was no gene flow between the two **groups**✓
 - Each **group** experienced different environmental conditions✓
 - and underwent natural selection independently✓
 - The individuals in each **group** became different✓
 - genotypically and phenotypically✓
 - to form the pottos and lemurs✓*
 - Eventually if the two groups are mixed again, they cannot interbreed✓/produce fertile offspring. *2 Compulsory + Any 4|

(6)

(10)

Question 4.14

- 4.14.1 Biogeography✓

(1)

- 4.14.2 - Similar organisms✓
- that can interbreed✓
 - to produce fertile offspring✓

(3)

- 4.14.3 - The original population /common ancestor once lived on a large continent✓
 - and became separated by continental drift✓/oceans - There was no gene flow amongst the three populations✓*
 - Each population experienced different environmental conditions✓ - and underwent natural selection independently✓
 - The individuals in each population became different✓ - genotypically and phenotypically✓
 - Even if the (three) populations are mixed again✓
 - they would not be able to interbreed✓/produce fertile offspring - forming the different species, the coyote, jackal, and dingo✓ * (7)
 2 compulsory* + any 5 (11)

Question 4.15

- 4.15.1 Ambulocetus✓ (1)
 4.15.2 It had flipper-like large feet and a tail✓✓ (2)
 (Mark first ONE only)
 4.15.3 - They share characteristics/have intermediate characteristics
 - of the ancestor/Pakicetus✓s and the present-day species/ ✓
 Balaena
OR
 - They have legs like Pakicetus a✓and
 - flippers of the present day Balaena✓ (2)
 4.15.4 - Ancestral species of whales all had legs✓/lived on land
 - As more time was spent in the water✓in search of food
 - the legs were used less a✓and disappeared
 - the acquired characteristic was passed on to the next generation✓ (3)
 Any 3 (8)

Question 4.16

- 4.16.1 - A group of organisms of the same species✓
- occupying the same habitat✓
- at the same time✓ (3)
- 4.16.2 They produce infertile offspring✓
(Mark first ONE only) (1)
- 4.16.3 - Breeding at different times of the year✓
- Species-specific courtship behaviour✓
- Adaptation to different pollinators ✓
- Prevention of fertilisation✓ Any (3)
- (Mark first THREE only) (7)

Question 4.17

- 4.17.1 Artificial selection✓ /selective breeding (1)
- 4.17.2 -They chose dogs with desirable traits✓
-and interbred✓ them to
-produce offspring with these traits✓ (3)
- 4.17.3 -Allow them to interbreed with each other✓
-and see whether they produce fertile offspring✓
OR
- Analysis of DNA✓
-to check for matching sequences✓ (2)
- 4.17.4 -Rhodesian ridgeback✓
-is strong, athletic and fast✓
-is able to catch the prey✓ Any (2)
- 4.17.5 -Due to reduction in gene pool✓ /variation
-they will not be able to hunt✓ /find shelter/defend themselves
-as well as wolves are able to✓ (3)
- therefore unable to survive in the wild✓ (11)

Question 4.18

- 4.18.1 (a) Probability of developing resistance to antiretroviral drugs✓ (1)
(b) Number of missed treatments✓ (1)
- 4.18.2 Treatment must not be missed✓ (1)
- 4.18.3 The probability of HIV developing resistance to antiretroviral drugs increases with the increase in the number of missed treatments✓✓
OR
The more the days of missed treatment, the greater the probability of the virus developing resistance to antiretroviral drugs✓✓ (2)

- 4.18.4 - There is variation in the resistance ✓ of the HI virus to antiretroviral drugs
 - Some viruses are resistant✓ to the drugs and
 - others are not resistant✓
 - Those that are not resistant do not survive✓
 - When treatments are missed ✓
 - the resistant viruses survive and reproduce✓
 - passing the resistance to their offspring✓ (5)
- Any (10)

Question 4.19

- 4.19.1 - Bare fingertips✓/nails instead of claws
 - Opposable thumbs✓/ gripping ability
 - Fingerprints✓
 - Five fingers✓ Any (1)
- (Mark first ONE only)**

4.19.2

Differences between African apes and humans	
African apes	Humans
- Small cranium✓	- Large cranium✓
- Brow ridges are well developed✓	- Brow ridges are not well developed✓
- Large canines✓	- Small canines✓
- Palate is long and rectangular✓ / U-shaped	- Palate is small and semi-circular✓/ C-shaped
- Large jaws✓	- Small jaws✓
- More protruding jaws✓/ prognathous	- Less protruding jaws✓/non-prognathous
- Cranial ridges present✓	- No cranial ridge✓
- Foramen magnum in a backward position✓	- Foramen magnum in a forward position✓
- Sloping face✓	- Flat face✓
- Less developed zygomatic arch✓	- More developed zygomatic arch✓
- Less developed chin✓	- More developed chin✓
- Diastema between the teeth✓	- No diastema between the teeth✓

(7)

(Mark first THREE only) Table 1 + (3 x 2)

- 4.19.3 - Short✓ and
 - wide✓/broad
 - Cup-shaped✓ Any (2)
- (Mark first TWO only)**
- (10)

Question 4.20

- 4.20.1 Walking on two legs✓✓ (2)
- 4.20.2 (a) - Foramen magnum moved to a more forward position✓
- to allow the spinal cord to enter vertically✓ (2)
- (b) - Pelvic girdle is short and wide✓/broad
- to support the upper body✓ (2)
- (c) - Spine is more curved✓/S shaped
- to absorb shock✓/allow flexible movement/support (2)
- (8)**

Question 4.21

- 4.21.1 - To show a possible common ancestor✓
- To identify trends in evolution✓ (1)
- 4.21.2 - Both have opposable thumbs✓ (2)
- to allow for a power grip✓ /precision grip/ any example thereof
- 4.21.3 - Humans have small teeth✓ /canine whereas
African apes have large teeth✓ /canines (2)
- There are no gaps✓ /diastema between the teeth in humans
whereas African apes have gaps✓/ diastema between the teeth
- (5)**

Question 4.22

4.22.1

Skull 1	Skull 2
Brow ridges pronounced✓	Brow ridges less pronounced✓
More protruding jaws✓/prognathous	Less protruding jaws✓/non-prognathous
Larger jaws✓	Smaller jaws✓
Smaller cranium size✓	Larger cranium size✓
Larger teeth✓/ canines	Smaller teeth✓/canines
Poorly developed chin✓	Well developed chin✓
Sloping face✓	Flat face✓

(Mark first THREE only)

Table 1 + (3 x 2)

(7)

4.22.2

- Freely rotating arms✓
- Long upper arms✓
- Rotation around elbow joints✓
- Rotation around the wrists✓
- Opposable thumbs✓
- Bare fingertips✓/ nails instead of claws
- Five fingers✓/pentadactyl limb
- Fingerprints present✓

(Mark first FOUR only)

Any

(4)

4.22.3

- Since the cranium houses the brain✓
- a large cranial volume indicates a larger brain✓/more brain cells
- which suggests greater intelligence✓

(3)

(14)

Question 4.23

4.23.1 B✓

(1)

4.23.2 - The foramen magnum is in a more forward position✓✓

(2)

(Mark first ONE only)

4.23.3

	A		B
1	Larger canines✓	1	Smaller canines✓
2	Jaws with teeth in a rectangular/U shape✓	2	Jaws with teeth on a gentle/round curve✓
3	More protruding jaw✓/ prognathous	3	Less protruding jaw✓/non-prognathous

(Mark first TWO only)

Table 1 + Any (2 x 2)

(5)

4.23.4

- The spine is S-shaped✓*
- for flexibility✓ and
- shock absorption✓

1* compulsory + Any 1

(2)

(10)

Question 4.24

4.24.1 (a) X✓, Z✓ (in any order)
(Mark first TWO only) (2)

(b) C✓ (1)

4.24.2 - The pelvis is long✓
- and narrow✓ (2)

4.24.3 - The spine✓
- is S-shaped for the bipedal organism✓
- and C-shaped for the quadrupedal organism✓

OR

- The foramen magnum✓
- is in a more forward position in bipedal organisms✓
- and in a backward position in quadrupedal organisms✓
(Mark first ONE only) (3)

(8)

Question 4.25

4.25.1 X - Foramen magnum✓
Y - Canine✓ (2)

4.25.2 - The foramen magnum is located in a more forward position✓ below the skull
- showing that organism C is bipedal✓
- This allows for the vertebral column/spine to extend vertically✓ from the base of the skull
- to balance the body weight in upright walking✓ Any (3)

4.25.3 (a) B✓ (1)

(b) A✓ (1)

4.25.4 - There is an increase✓
- in the cranium size✓ from organism B to organism C (3)
- This will allow it to house a larger brain✓/cerebrum which suggests greater intelligence

(10)

Question 4.26

- 38.1
- The jaw is large in the chimpanzee✓ and small in *Homo sapiens*✓
 - The jaw/ palate is rectangular in the chimpanzee✓ and rounded in *Homo sapiens*✓
 - Large spaces between the teeth in the chimpanzee✓ and small/no spaces in *Homo sapiens*✓
 - Large canines/teeth in the chimpanzee✓ and small canines/teeth in *Homo sapiens*✓
- Any 1 x 2 (2)
- (Mark first ONE only)

- 38.2
- The diet changed from eating raw food✓ in *Australopithecus*
 - to a diet of cooked food✓ in *Homo sapiens*
- (2)

- 38.3 (a) A transitional species shows intermediate characteristics between two genera/species✓

OR

It has characteristics common to both the ancestor species and the species that follows✓ (1)

- (b) The jaw is smaller than that of the chimpanzee but larger than that of *Homo sapiens*✓✓

OR

The canines/ teeth are smaller than those of the chimpanzee but larger than those of *Homo sapiens*✓✓

OR

The jaw/ palate shape is more rounded than that of the chimpanzee but less rounded than that of *Homo sapiens*✓✓ (2)
Any 1 x 2

(Mark first ONE only)

(7)

Question 4.27

- 4.27.1 Karabo✓ (1)
4.27.2 Australopithecus africanus✓ (1)
4.27.3 a) (Lee) Berger✓ (1)
b) (Raymond) Dart✓ (1)
(4)

Question 4.28

- 4.28.1 (a) - Sahelanthropus✓
- Australopithecus✓
- Homo✓ Any (2)
(Mark first TWO only)
- (b) - Taung child✓
- Mrs Ples✓
- (Little foot)✓ Any (2)
(Mark first TWO only)
- 4.28.2 (c) Sahelanthropus✓ (1)
- 4.28.3 Homo neanderthalensis✓ (1)
- 4.28.4 650✓ cm³ (1)
- 4.28.5 2,0 mya✓/2 000 000 years ago (1)
- Genetic✓ evidence (2)
Cultural✓ evidence
(Mark first TWO only)
- (10)

Question 4.29

- 4.29.1 - Modern humans originated in Africa✓ and
- then migrated to other continents✓ (2)
- 4.29.2 Hominidae✓ (1)
- 4.29.3 Mitochondrial DNA✓ (1)
- 4.29.4 - Fossils of *Ardipithecus* were found in Africa only✓
- Fossils of *Australopithecus* were found in Africa only✓
- Fossils of *Homo habilis* were found in Africa only✓
- The oldest fossils of *Homo erectus* were found in Africa✓
- The oldest fossils of *Homo sapiens* were found in Africa✓ (4)
- Any (8)

Question 4.30

- 4.30.1 (Modern) humans originated in Africa and migrated to other parts of the world (2)
- 4.30.2 - Fossils of *Ardipithecus* were found in Africa only✓
- Fossils of *Australopithecus* were found in Africa only✓
- Fossils of *Homo habilis* were found in Africa only✓
- The oldest fossils of *Homo erectus* were found in Africa✓ / while the younger fossils of *Homo erectus* were found in other parts of the world✓
- The oldest fossils of *Homo sapiens* were found in Africa✓ / while the younger fossils of *Homo sapiens* were found in other parts of the world✓ (6)
- Any 6 (8)

Question 4.31

- 4.31.1 Phylogenetic✓ (1)
- 4.31.2 (a) 5✓ (1)
(b) 4✓ (1)
- 4.31.3 (*Paranthropus*) *robustus*✓ and (*Paranthropus*) *boisei*✓ (2)
- 4.31.5 (a) Accept any value in the range 4,3 to 4,5 million years ago✓/mya (1)
(b) 1 mya✓ (1)
- 4.31.6 (a) *Homo neanderthalensis*✓ (1)
(b) *Homo habilis*✓ (1)
- (9)

Question 4.32

- 4.32.1 Phylogenetic tree✓/cladogram (1)
- 4.32.2 2✓/Two (1)
- 4.32.3 (a) Homo habilis✓ (1)
- (b) (Homo) naledi✓ (1)
- 4.32.4 (Homo) sapiens✓ (1)
- 4.32.5 - Fossil✓ evidence
- Cultural✓ evidence
- Genetic✓ evidence
- (Mark first TWO only)** Any 2 (2)
- 4.32.6 - A large cranial capacity✓ in Homo sapiens
- indicates a larger brain✓
- leading to greater intelligence✓
- OR**
- A small cranial capacity✓ in Australopithecus africanus
- indicates a smaller brain✓ (3)
- leading to lower intelligence✓
- 4.32.7 - Fossils of Australopithecus spp. were found in Africa only✓ and
- fossils of species X/Homo habilis were found in Africa only✓
- The oldest fossils of Homo erectus were found in Africa✓ /the younger fossils were found elsewhere
- indicating that modern humans originated in Africa and migrated out of Africa✓ (4)
- (14)**